

CLAIMS

What is claimed is:

- 1 1. An exhaust-vibration decoupling connector comprising:
 - 2 an inlet tube extended downstream from a decoupler inlet to proximate
 - 3 an upstream portion of a damper fixture, said inlet tube having outlet radial bend
 - 4 around a circumference on an upstream end to interlock with an outlet tube;
 - 5 an outlet tube extended upstream from a decoupler outlet to proximate
 - 6 a downstream portion of the damper fixture, said outlet tube having an inward radial
 - 7 bend on a downstream end which interlocks with the bend on the inlet tube;
 - 8 the damper fixture being proximate midway between the decoupler inlet
 - 9 and the decoupler outlet;
 - 10 a vibration damper positioned removably in the damper fixture;
 - 11 a bellows having an upstream bellows attachment proximate the
 - 12 decoupler inlet;
 - 13 the bellows having a downstream bellows attachment proximate the
 - 14 decoupler outlet;
 - 15 the bellows having a bellows inside perimeter that is positioned radially
 - 16 outward predeterminedly from a radially outside perimeter of the vibration damper;
 - 17 the bellows inside perimeter including inside peripheries of undulations
 - 18 of the bellows;
 - 19 a flex cover having an upstream flex attachment proximate the decoupler
 - 20 inlet;
 - 21 the flex cover having a downstream flex attachment proximate the
 - 22 decoupler outlet;
 - 23 the flex cover having a cover inside perimeter that is positioned
 - 24 proximate a bellows outside perimeter;
 - 25 a shield sleeve having a shield attachment proximate the decoupler
 - 26 outlet; and

27 the shield sleeve having a shield inside perimeter that is positioned
28 radially outward predeterminedly from a radially outside perimeter of the flex cover.

1 2. The exhaust-vibration decoupling connector of claim 1 wherein:
2 the upstream bellows attachment includes an upstream bellows sleeve
3 extending downstream axially a predetermined attachment distance from proximate
4 the decoupler inlet to a first undulation wall that is extended radially intermediate the
5 upstream bellows sleeve and a first side of a first undulation of the bellows;
6 the downstream bellows attachment includes a downstream bellows
7 sleeve extending upstream axially a predetermined attachment distance from
8 proximate the decoupler outlet to a second undulation wall that is extended radially
9 intermediate the downstream bellows sleeve and a second side of a last undulation of
10 the bellows;
11 the upstream bellows sleeve includes an inside periphery that is
12 positioned removably on an outside periphery of a fastener portion of the inlet tube;
13 and
14 the downstream bellows sleeve includes an inside periphery that is
15 positioned removably on an outside periphery of a fastener portion of the outlet tube.

1 3. The exhaust-vibration decoupling connector of claim 2 wherein:
2 the upstream flex attachment includes an upstream flex-cover sleeve
3 extending downstream axially a predetermined attachment distance from proximate
4 the decoupler inlet to a first flex-cover wall that is extended radially intermediate the
5 upstream flex-cover sleeve and a first attachment side of the flex cover; and
6 the downstream flex attachment includes a downstream flex-cover sleeve
7 extending upstream axially a predetermined attachment distance from proximate the
8 decoupler outlet to a second flex-cover wall that is extended radially intermediate the
9 downstream flex-cover sleeve and a second attachment side of the flex cover.

1 **4.** The exhaust-vibration decoupling connector of claim 3 wherein:
2 the upstream flex-cover sleeve includes an inside periphery that is
3 positioned removably on an outside periphery of the upstream bellows sleeve; and
4 the downstream flex-cover sleeve includes an inside periphery that is
5 positioned removably on an outside periphery of the downstream bellows sleeve.

1 **5.** The exhaust-vibration decoupling connector of claim 1 wherein:
2 the inlet tube is circumferential with an inside periphery and an outside
3 periphery;
4 the outlet tube is circumferential with an inside periphery and an outside
5 periphery;
6 the inside periphery and the outside periphery of the inlet tube are
7 predeterminedly smaller than the inside periphery and the outside periphery of the
8 outlet tube;
9 the damper fixture includes an inlet-tube step extended radially inward
10 to a damper seat having an axial downstream extension of the inlet tube;
11 the damper fixture includes an outlet-tube step extended radially inward
12 to predeterminedly proximate an outside periphery of the damper seat;
13 the inlet-tube step includes a first side of the damper fixture; and
14 the outlet-tube step includes a second side of the damper fixture.

1 **6.** The exhaust-vibration decoupling connector of claim 5 wherein:
2 the outlet-tube step is articulated to allow axial and pivotal travel of the
3 outlet tube in relation to the inlet tube predeterminedly.

1 **7.** The exhaust-vibration decoupling connector of claim 5 wherein:
2 the vibration damper includes a mesh-wire washer having an inside
3 periphery that is positioned removably on the damper seat, an outside periphery that
4 is predeterminedly smaller than the bellows inside periphery, a first side proximate
5 the inlet-tube step and a second side proximate the outlet-tube step.

1 **8.** The exhaust-vibration decoupling connector of claim 5 wherein:
2 the vibration damper includes a wave-spring damper having one or more
3 wave springs intermediate wave-spring washers in detachably sealed contact with the
4 inlet-tube step and the outlet-tube step.

1 **9.** The exhaust-vibration decoupling connector of claim 5 wherein:
2 the vibration damper includes a helical-spring damper;
3 the helical-spring damper has a first side in detachable contact with the
4 inlet-tube step and a second side in detachably contact with the outlet-tube step.

1 **10.** The exhaust-vibration decoupling connector of claim 5 wherein:
2 the vibration damper includes a spring-side damper having a helical
3 spring in a circumferential channel with a first wall adjacent to the inlet-tube step and
4 a second wall adjacent to the outlet-tube step;
5 the circumferential channel is arcuate intermediate the first wall and the
6 second wall; and
7 the first wall and the second wall have inside peripheries proximate the
8 outside periphery of the damper seat.

1 **11.** The exhaust-vibration decoupling connector of claim 1 and further
2 comprising:

3 the flex cover includes a heat-resistant and flexible material that is
4 reinforced with wire network predeterminedly.

1 **12.** The exhaust-vibration decoupling connector of claim 1 wherein:
2 the flex cover includes braided-wire material.

1 **13.** The exhaust-vibration decoupling connector of claim 12 wherein:
2 the flex cover includes a braid cap that is positioned intermediate the
3 upstream flex attachment and exhaust-outlet structure to which the exhaust-vibration
4 decoupling connector is attachable.

1 **14.** The exhaust-vibration decoupling connector of claim 1 wherein:
2 the upstream bellows attachment is articulated for sealed attachment to
3 a predetermined exhaust-outlet structure; and
4 the downstream bellows attachment is articulated for sealed attachment
5 to a predetermined exhaust-treatment structure that is fluidly downstream from the
6 exhaust-outlet structure.

1 **15.** The exhaust-vibration decoupling connector of claim 13 wherein:
2 the upstream bellows attachment is disposed a snug-fit distance from the
3 downstream bellows attachment for fitting snugly intermediate the exhaust-outlet
4 structure and the exhaust-treatment structure predeterminedly.

1 **16.** The exhaust-vibration decoupling connector of claim **15** wherein:
2 the shield sleeve has a shield length that is less than the snug-fit distance
3 for allowing axial distance change between the decoupler inlet and the decoupler
4 outlet and for allowing pivotal movement of the decoupler outlet predeterminedly.

1 **17.** The exhaust-vibration decoupling connector of claim **1** wherein:
2 the bellows includes flexibly parallel walls intermediate arcuately
3 flexible floors and roofs.

1 **18.** The exhaust-vibration decoupling connector of claim **17** wherein:
2 the bellows includes oppositely disposed ends that are buttressed against
3 oppositely disposed end walls of the flex cover.

1 **19.** The exhaust-vibration decoupling connector of claim **1** wherein:
2 the bellows includes damping filler intermediate internal walls of
3 undulations of the bellows.

1 **20.** The exhaust-vibration decoupling connector of claim **19** wherein:
2 the damping filler includes mesh wire.

1 **21.** An exhaust-vibration decoupling connector comprising:
2 an inlet tube extended downstream from an upstream portion of the inlet
3 tube proximate a decoupler inlet to proximate an upstream portion of a damper
4 fixture, said inlet tube having outward radial bend around a circumference on an
5 upstream end to interlock with an outer tube;
6 an outlet tube extended upstream from a downstream portion of the
7 outlet tube proximate a decoupler outlet to proximate a downstream portion of the
8 damper fixture, said outlet tube having an inward radial bend on a downstream end
9 which interlocks with the bend on the inlet tube;
10 the damper fixture being proximate midway between the decoupler inlet
11 and the decoupler outlet;
12 a vibration damper positioned removably in the damper fixture;
13 a bellows having an upstream bellows attachment proximate the
14 decoupler inlet;
15 the bellows having a downstream bellows attachment proximate the
16 decoupler outlet;
17 the bellows having a bellows inside perimeter that is positioned radially
18 outward predeterminedly from a radially outside perimeter of the vibration damper;
19 the bellows inside perimeter including inside peripheries of the bellows;
20 a flex cover having an upstream flex attachment proximate the decoupler inlet;
21 the flex cover having a downstream flex attachment proximate the
22 decoupler outlet; and
23 the flex cover having a cover inside perimeter that is positioned
24 proximate a bellows outside perimeter.

1 **22.** The exhaust-vibration decoupling connector of claim 21 wherein:

2 the upstream bellows attachment includes an upstream bellows sleeve
3 extending downstream axially a predetermined attachment distance from proximate
4 the decoupler inlet to a first undulation wall that is extended radially intermediate the
5 upstream bellows sleeve and a first side of a first undulation of the bellows;

6 the downstream bellows attachment includes an downstream bellows
7 sleeve extending upstream axially a predetermined attachment distance from
8 proximate the decoupler outlet to a second undulation wall that is extended radially
9 intermediate the downstream bellows sleeve and a second side of a last undulation of
10 the bellows;

11 the upstream bellows sleeve includes an inside periphery that is
12 positioned removably on an outside periphery of a fastener portion of the inlet tube;

13 the downstream bellows sleeve includes an inside periphery that is
14 positioned removably on an outside periphery of a fastener portion of the outlet tube;

15 the inlet tube is circumferential with an inside periphery and an outside
16 periphery;

17 the outlet tube is circumferential with an inside periphery and an outside
18 periphery;

19 the inside periphery and the outside periphery of the inlet tube are
20 predeterminedly smaller than the inside periphery and the outside periphery of the
21 outlet tube;

22 the damper fixture includes an inlet-tube step extended radially inward
23 to a damper seat having an axial downstream extension of the inlet tube;

24 the damper fixture includes an outlet-tube step extended radially inward
25 to predeterminedly proximate an outside periphery of the damper seat;

26 the inlet-tube step includes a first side of the damper fixture; and

27 the outlet-tube step includes a second side of the damper fixture.

1 **23.** The exhaust-vibration decoupling connector of claim 22 wherein:
2 the outlet-tube step is articulated to allow axial and pivotal travel of the
3 outlet tube in relation to the inlet tube predeterminedly.

1 **24.** The exhaust-vibration decoupling connector of claim 22 wherein:
2 the vibration damper includes a mesh-wire washer having an inside
3 periphery that is positioned removably on the damper seat, an outside periphery that
4 is predeterminedly smaller than the bellows inside periphery, a first side proximate
5 the inlet-tube step, and a second side proximate the outlet-tube step.

1 **25.** The exhaust-vibration decoupling connector of claim 22 wherein:
2 the vibration damper includes a helical-spring damper;

1 **26.** The exhaust-vibration decoupling connector of claim 22 wherein:
2 the vibration damper includes a wave-spring damper.

1 **27.** The exhaust-vibration decoupling connector of claim 22 wherein:
2 the vibration damper includes a spring-side damper having a helical
3 spring in a circumferential channel with a first wall adjacent to the inlet-tube step and
4 a second wall adjacent to the outlet-tube step;
5 the circumferential channel is arcuate intermediate the first wall and the
6 second wall; and
7 the first wall and the second wall have inside peripheries proximate the
8 outside periphery of the damper seat.

1 **28.** The exhaust-vibration decoupling connector of claim **21** wherein:
2 the upstream bellows attachment is articulated for sealed attachment to
3 a predetermined exhaust-outlet structure; and
4 the downstream bellows attachment is articulated for sealed attachment
5 to a predetermined exhaust-treatment structure that is fluidly downstream from the
6 exhaust-outlet structure.

1 **29.** The exhaust-vibration decoupling connector of claim **21** wherein:
2 the upstream bellows attachment is disposed a snug-fit distance from the
3 downstream bellows attachment for fitting snugly intermediate the exhaust-outlet
4 structure and the exhaust-treatment structure predeterminedly.

1 **30.** The exhaust-vibration decoupling connector of claim **21** wherein:
2 the bellows includes flexibly parallel walls intermediate arcuately
3 flexible floors and roofs.

1 **31.** The exhaust-vibration decoupling connector of claim **21** wherein:
2 the bellows includes damping filler intermediate internal walls of
3 undulations of the bellows.

1 **32.** The exhaust-vibration decoupling connector of claim **21** wherein:
2 the damping filler includes mesh-wire rings.